

**APPLICATION
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**TITLE: INFRARED TRANSMISSIVE INTEGRATED
 CIRCUIT SOCKET CAP**

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INFRARED TRANSMISSIVE INTEGRATED CIRCUIT SOCKET CAP

Background

This invention relates generally to socket caps for integrated circuits and, particularly, for integrated circuit microprocessors.

5 A microprocessor may be secured to a printed circuit board, such as a motherboard, through a socket. The socket may include pins that make electrical connections to the integrated circuit contacts and solder balls which electrically and mechanically secure the socket and the 10 processor to the circuit board.

Conventionally, surface mount technique are utilized to secure the socket in place to the circuit board. To this end, the socket is positioned appropriately on the circuit board and heat is applied using a surface mount 15 reflow oven. The surface mount reflow oven provides both infrared and convective heating.

Prior to the insertion of the processor into the socket and while the socket is being secured to the board, the top side of the socket may be protected by a plastic 20 cap. Conventionally, that plastic cap is removably securable over the socket. Once the socket has been surface mounted to the printed circuit board and the processor is ready to be installed, the cap may be removed.

Generally, a microprocessor manufacturer may provide an integrated circuit chip to an original equipment manufacturer, such as a personal computer manufacturer or a motherboard manufacturer. The original equipment

5 manufacturer or other installer surface mounts the package to an appropriate printed circuit board. To this end a surface mount reflow oven is utilized. It has been learned that in many cases, it is necessary to apply undesirably high heat in order to get reflow of the solder balls used

10 in the surface mount connection. The socket, in some cases, acts as a heat sink and prevents the solder balls from reflowing fast enough in the desired reflow profile. As a result, the solder joints may not receive enough heat, causing solder joint reliability issues.

15 Thus, there is a need for better ways to surface mount sockets to printed circuit boards.

Brief Description of the Drawings

Figure 1 is an enlarged, perspective view of one embodiment of the present invention;

20 Figure 2 is an enlarged, exploded perspective view in accordance with one embodiment of the present invention;

Figure 3 is an enlarged, top plan view of a cap in accordance with one embodiment of the present invention;

25 Figure 4 is a cross-sectional view taken generally along the line 4-4 in Figure 3;

Figure 5 is a cross-sectional view taken generally along the line 5-5 in Figure 4;

Figure 6 is a cross-sectional view taken generally along the line 6-6 in Figure 3;

5 Figure 7 is a cross-sectional view taken generally along the line 7-7 in Figure 6;

Figure 8 is an enlarged, plan view of the inside of the cover of the socket shown in Figure 1 in accordance with one embodiment of the present invention;

10 Figure 9 is a schematic depiction of the process of surface mounting the socket to a printed circuit board in accordance with one embodiment of the present ivnetion;

15 Figure 10 is a partial, cross-sectional view of the process of surface mounting the socket to a printed circuit board in accordance with one embodiment of the present invention;

Figure 11 is an enlarged, cross-sectional view corresponding to Figure 10 of another embodiment of the present invention; and

20 Figure 12 is a cross-sectional view of a cap in accordance with still another embodiment of the present invention.

Detailed Description

Referring to Figure 1, a processor socket 10 may be an LG775 socket, also known as a socket T, in accordance with one embodiment of the present invention. It includes a 5 socket housing 28 which is hingedly connected to a socket cover 14. The socket cover 14 may in turn be itself covered by an infrared transmissive cap 24.

The cover 14 may include curved prongs 22 which engage the housing 28 to allow pivotal motion of the cover 14 10 relative to the housing 28. The housing 28 may include a bar 16 which removably latches the cover 14 in the closed position shown in Figure 1. The bar 16 is integral with a lever arm 13 which may be pivoted to release the cover 14. When not in use, the cover 14 is locked closed by engaging 15 the lever arm 13 under the catch 58. The lever arm 13 may be L-shaped in one embodiment and may be retained under a U-shaped portion 20 of the housing 28.

The cap 24 may be formed of an infrared transmissive material. In one embodiment, the cap 24 transmits 80% of 20 incident infrared radiation and, in a more advantageous embodiment, transmits 90% of incident infrared radiation. Among the materials that may be useful are plastic, glass, ceramics, and organic materials that are transparent or translucent to infrared radiation. Advantageously, the cap 25 24 may be made of a clear or translucent material which transmits infrared radiation. It may also be dark red translucent material since dark red is infrared

transmissive, generally. The cap 24 may also include a plurality of peripherally situated slots 38 which allow air communication into the region underneath the cap 24.

The cap 24 may have two functions. It may perform the
5 traditional cap function of preventing contamination or damage to socket 10 leads from the manufacturing processes up until the time the cap 24 is removed and the processor is inserted. However, the cap 24 may also assist in facilitating surface mounting of the socket 10 to a printed
10 circuit board.

By permitting the transmission of infrared light, conventional surface mount ovens may more effectively heat solder balls to surface mount the socket 10 to a printed circuit board. Conventional surface mount ovens may supply
15 both convective heat and infrared heat. Conventional caps tend to block the infrared heating. As a result, ineffective heating may occur, resulting in solder ball reliability problems.

The provision of the openings 38 may improve
20 convective heat transfer through the cap 24 to the underlying solder balls in some cases. In one embodiment of the present invention, using a red translucent plastic cover, 95 percent of the infrared radiation penetrates the cap 24 without reflection or absorption. The infrared
25 radiation may pass through the cap 24 to become absorbed by the socket leads which are thermally attached to solder balls at the bottom of the socket 10. This allows the

solder balls to reach higher reflow temperatures faster, permitting the socket 10 to stay within the desired reflow specifications. Excessive heating may adversely affect the socket 10 in some cases.

5 Referring to Figure 2, the cap 24 may be removably secured to the cover 14 in one embodiment of the present invention. A plurality of tabs, including the spring based tabs 32, may releasably secure the cap 24 on the cover 14. An integrated circuit may protrude through opening 24 of
10 the cover 14 after the socket 10 is surface mounted to a printed circuit board. As better seen in Figure 2, the hook-like elements 22 engage appropriate slots in the housing 28 to provide a pivotal connection between the cover 14 and the housing 28.

15 As better shown in Figure 3, the underside of the cap 24 includes standoffs 46 and lands 48 to appropriately space the cap 24 from the underlying cover 14. In addition, the cap 24 may have a catch 34 mounted on a prong 32 to removeably secure the cap 24 to the cover 14 in a
20 removable fashion. Thus, a pair of catches 34 may releasably engage the spaced portions 33 (Figure 2) on the cover 14.

As shown in Figures 4 and 5, a catch 34 is positioned at the end of the prong 32 so as to engage the cover 14.
25 At the same time on the opposite edge of the cap 24, as shown in Figures 3, 6, and 7, tabs 42 may releasably engage the cover 14. In particular, each upwardly extending tab

42 has a catch 40 on its free end to spring engage the opposite edge of the cover 14 in the region 15 (Figure 2). In one embodiment, the tabs 42 may be mounted on the spring arms 36 which extend in an L-shaped arrangement. This 5 allows spring adjustment in multiple directions of the engagement between the catch 40 and the portion 15 of the cover 14.

The alignment between the cap 24 and the cover 14 is facilitated by the guide 44. The guide 44 may serve to 10 protect the element 42 and to guide the engagement of the cap 24 on the cover 14 in some cases.

Thus, referring to Figure 8, the catch 40 engages the cover 14 at the portion 15 on one edge, while the catch 34, on the opposite edge, engages the region 33 of the cover 15 14. In this case, no integrated circuit has yet been positioned so an opening 24 is unfilled in the cover 14.

Referring to Figure 9, a surface mount oven 52 may generate both convective heat and infrared radiation to surface mount a socket 10 on a printed circuit board 50. 20 As shown in closer detail in Figure 10, the infrared radiation I may penetrate into the socket portion 54 to heat the solder balls 60 and reflow them. The convective heating is facilitated by the openings 38 in the cap 24. Convective heat from the oven 52 may more readily pass 25 through the openings 38 to access the interior regions proximate to the solder balls 60.

In accordance with another embodiment of the present invention shown in Figure 11, the underside of the socket 24a may be curved. This curvature may advantageously, in some embodiments, further enhance infrared heating. The 5 curved surface 62 on the bottom of a cap 24a reflects the infrared energy back away from the cap lower surface.

In accordance with still another embodiment of the present invention, openings 38 in a modified cap 24b may have downwardly protruding tabs 56 that reflect infrared 10 radiation I. The infrared radiation may be reflected by the tabs 56 and directed into the open region below the cap 24b.

While the present invention has been described with respect to a limited number of embodiments, those skilled 15 in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is: